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Dated 19 May 1999

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The **Patent Office**

19 JAN 1999

19JAN99 E418657-1 D00278
P01/7700 0.00 - 9901018.3

Request for grant of a patent

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The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference: JL2001

2. Patent application number *(The Patent Office will fill in this part)*: **9901018.3**

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*:

BASS PUBLIC LIMITED COMPANY
NO. 1 FIRST AVENUE
CENTRUM 100
BURTON-ON-TRENT
STAFFORDSHIRE

Patents ADP number *(if you know it)*: 6439590001

If the applicant is a corporate body, give the country/state of its incorporation: ENGLAND

THE PATENT OFFICE
19 JAN 1999
RECEIVED BY POST

4. Title of the invention: BEER

5. Name of your agent *(if you have one)*: BARKER BRETTELL

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*:

138 HAGLEY ROAD
EDGBASTON
BIRMINGHAM
B16 9PW

Patents ADP number *(if you know it)*: 7442494002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of Filing *(day/month/year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day/month/year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d)): YES

Patents Form 1/77

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Description	18 + 18
Claim(s)	6 + 6
Abstract	-
Drawing(s)	5 + 5

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Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	-
Request for preliminary examination *(Patents Form 9/77)*	-
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	-

11. I/We request the grant of a patent on the basis of this application.

Signature: BARKER BRETTELL

Date: 18.01.99

12. Name and daytime telephone number of person to contact in the United Kingdom: JOHN LAWRENCE TEL: 0121-456 1364

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BEER

This invention relates to beer, and to methods of presenting or serving beer. In particular (although not exclusively) the invention relates to glasses, or other vessels, of beer.

The invention is a development of the technique disclosed in our co-pending Application No. GB 9810309.6.

In this specification and in any claims appended hereto the term "beer" is not restricted to proper beer, but encompasses any beverage that is capable of sustaining a head and that has a dissolved gas content (and that has a water content). Traditional usage of "beer" may be thought of as meaning, a beverage comprising hops flavouring, an alcohol content derived from malt and fermentation, a water content, and a dissolved gas content. However, as discussed above "beer" in this patent may mean some other beverage comprising a water content and a dissolved gas content which term comprehends a flavoured alcoholic beverage, for example an alcoholic lemonade or other alcopop-style of drink.

Thus the term "beer" embraces a variety of alcoholic beverages including lager, ale, porter, stout, cider and aforesaid flavoured alcoholic beverages. It also covers non-alcoholic drinks, and so-called low alcohol drinks.

According to a first aspect of the invention there is provided beer in an open-topped vessel wherein said beer has a head of foam over ice, said ice being formed in the beer from water of said water content.

Preferably there is a layer of ice adjacent the head, in contact with the head. Preferably there is a projection of ice extending downwards, away from the head, and being provided in the region of the head. The projection of the ice may depend directly from the head, or from a layer of ice beneath the head.

The ice is preferably made of many small crystals of ice, rather than a single solid mass. The ice is preferably slushy in character, rather than being a solid mass. There may be more than one kind of ice formation in the beverage. There may be a fine, powdery ice. There may be a flaky ice, of the order of 1 or 2mm or 3mm or 4mm, or more, in their longest dimension of the flakes.

The beer may have bands, or stripes, across it at different heights, the bands possibly being white layers where nucleation is taking place, and beer-coloured layers interposed between the white layers where less nucleation is taking place. This effect may be achieved by using ultrasound on the glass (or other container) of beer. The white bands may be of the order of 1, 2 or 3mm or so thick (in height), as may be beer-coloured bands between the white bands. The white bands and the interposed beer-coloured bands may be of substantially the same thickness.

The white bands interspersed by beer-coloured bands may exist for a matter of seconds, rather than minutes, and typically exist for 1 to 10 seconds, preferably about 3 to 6 seconds. The white bands/beer-coloured bands interspersed may exist for substantially the same time as ultrasound is applied to the glass (or other container) of beer.

Nucleation means may be provided to encourage the formation of the ice crystals and/or head in the beverage when it is in a glass or other container. The nucleation means is preferably the administration of ultrasound, preferably to the bottom portion of a glass of beverage, but it could be other forms of nucleation inducement. For example the glass and/or dispense tap/nozzle (or an object to be inserted into the glass of beverage) may have a roughened surface/high surface area surface to encourage nucleation (such as a sintered surface, etched surface, or a surface of ground material, such as glass); or a rapid and suitably large pressure drop may be provided to induce nucleation; or mechanical agitation may be provided; or the beverage may be arranged to have turbulent flow to promote nucleation; or an amount of liquid, possibly highly supersaturated with gas, may be introduced or injected; or gas may be otherwise introduced, or injected, or the glass may be vibrated in some way (e.g. by being exposed to sound waves, or the glass may be vibrated in some other way); or by introducing a chemical (e.g. tablet) or device which generates bubbles (for example a chemical pellet may effervesce or dissolve, releasing bubbles).

According to a second aspect of the invention there is provided a method of keeping beer in an open-topped vessel cool, said method comprising forming ice in the beer in the open-topped vessel having a cooling effect on the beer, said ice being formed in the beer from water of said water content.

According to a third aspect of the invention there is provided a method of sustaining cooling ice in beer in an open-topped vessel and wherein said ice is formed in the beer from water of said water content, said method comprising providing a head of foam on the beer such that in the vessel

said ice is covered by the head which acts as heat insulation above the ice against heat directed towards the ice from above the head.

According to a fourth aspect of the invention there is provided a method of sustaining a head on beer in an open-topped vessel, said method comprising providing a head on the beer and forming ice in the beer from water of said water content, and in said vessel said ice having a cooling effect on the head from below an upper part of the head.

According to a fifth aspect of the invention, there is provided a glass of beverage, the beverage being able to form a head and having a dissolved gas content as it is dispensed into the glass, the glass of beverage having a head overlying an ice formation made of many ice crystals, the ice formation having been produced by ice forming in the beverage as it was dispensed or after it was dispensed into the glass.

It will be appreciated that "glass" is not to be taken restrictively - any vessel of beverage may be considered a "glass of beverage" for this purpose. It is preferable that the glass be transparent or translucent, or at least have a window of transparent or translucent material.

Preferably the ice formation extends substantially the width of the mouth of the glass, or completely across the width of the mouth. It may comprise substantially homogenous ice crystals in a head-contacting region or layer. Alternatively, the ice crystals that contact the head may not be substantially homogeneous.

The ice formation may have a projection extending away from the head. The projection may comprise flakes of ice that are larger than the ice at the ice-head boundary.

The ice at the ice-head interface may have been formed before the ice flakes of the projection.

The beer may have been subjected to ultrasound signals and may be draught beer delivered into the vessel. Before the draught beer is delivered into the vessel, and preferably immediately before the beer may be cooled to a temperature below the freezing point of water at ambient atmospheric pressure.

According to a sixth aspect of the invention there is provided a method of serving draught beer in an open-topped vessel, said method comprising cooling the beer to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled beer into said vessel, said cooled beer being subjected to the effect of ultrasound signals (or other ice and/or gas bubble nucleation means).

The ultrasound signals may be applied externally of said vessel, and/or the ultrasound signals may be applied internally of said vessel to the cooled beer. In the latter case an ultra-sonic emitter provided as or incorporated into a probe may be disposed in the beer in the vessel. If desired a dispense outlet or nozzle from which the beer is delivered into the vessel may be adapted to act as an ultra-sonic emitter to provide aforesaid ultrasound signals to beer in the vessel. Such signals may be applied to beer as it passes through the dispense outlet.

Ultrasound signals can be applied to beer not only after it has been delivered into the vessel, but also whilst it is being delivered.

The ultrasound signals may have a frequency in the range of 20kHz to 70kHz. For example, the ultrasound signals may have a frequency of substantially 30kHz.

A mass of aforesaid ice may develop downwards in the beer below the head.

Preferably, the vessel is chilled before the beer is delivered thereinto. The vessel may be chilled to a temperature of substantially 4°C, or the vessel may be chilled to a temperature less than 4°C. For example, the vessel may be chilled to a temperature of substantially 0°C.

Prior to the delivery, and preferably just prior to the delivery, the draught beer may be cooled to a temperature between substantially -1°C and substantially -12°C. If desired, the beer may be cooled to a temperature between substantially -4°C and substantially -6°C. The greater the alcohol strength by volume, the lower the temperature to which the beer may be cooled. We may aim to achieve a dispense temperature of about -5°C for a lager (or other drink) with about 4.5 abv (or to substantially -4°C or substantially -6°C).

Preferably the vessel has a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion. Thus the vessel may be a glass drinking vessel.

Preferably the beer is a pale beer in colour. If desired the beer can be a lager, or a cider.

Aforesaid dissolved gas may comprise carbon dioxide and/or may comprise nitrogen. A dissolved nitrogen content in the beer may be in the

range of substantially zero parts per million (p.p.m.) to substantially 100 p.p.m. A dissolved carbon dioxide content may approach zero % by volume or be greater. Said carbon dioxide may be substantially at any of the following levels or in a range defined between any of the following levels: zero vols/vol, 0.5 vols/vol, 1 vols/vol 1.4 or 1.5 vols/vol, 2.0 vols/vol, 2.2 or 2.4 vols/vol, 3 vols/vol, 4 vols/vols or 5 vols/vol or above.

If desired, the ultrasound signals can be accompanied by a mechanically or electrically produced audible performance and/or a visible light display. The audible performance may be a tuneful or musical sound. The visible light display may comprise visible flashes of light.

If desired the beer can be subjected to the ultrasound within an enclosure arranged to conceal the vessel from view from at least one side of said enclosure.

According to a seventh aspect of the invention, there is provided a beer dispense apparatus comprising cooling means adapted to cool a beverage to below 0°C, a dispense tap, and beverage dispense pipework adapted to convey the beverage to the dispense tap, the arrangement being such that the apparatus is adapted to dispense a beverage cooled to below the point at which ice would normally form in the beverage if the beverage were left standing at atmospheric pressure and if nucleation means were provided for the standing beverage, and in which the undispensed beverage in the apparatus does not freeze solid.

Preferably, the apparatus includes pump means and the beverage dispense pipework may include a portion which circulates beverage past the dispense tap when the dispense tap is closed, the fact that cooled

undispensed beverage is kept flowing tending to prevent the formation of ice blockages at the dispense tap.

The beverage may be kept flowing past the dispense tap (or through it when it is open) at substantially all times that the beverage is at a temperature at which ice may otherwise form at the dispense tap or, in the beverage dispense pipework.

Preferably, there is a cold circulation loop in which is provided at least one cooling means and which connected to the dispense tap, beverage in the circulation loop being kept cold by the cooling means and being kept circulating by pump means provided in the circulation loop. There may be a plurality of cooling means (e.g. heat exchangers) in the circulation loop. There may be a plurality of dispense taps associated with the circulation loop.

Beverage upstream of the circulation loop may be cooled to a temperature above that at which ice may form in the beverage under the conditions of temperature and pressure experienced by the beverage in the pipework upstream of the circulation loop.

One advantage of a specific embodiment of the invention is that it enables us to provide cool beer using ice therein in a way which a consumer may find more agreeable because dilution of the drink cannot occur. Another advantage may be that we can provide a beer in which the existence of cooling ice therein may be sustained whereby the drink may be kept cold for an extended period of time.

A further advantage may be that we can provide beer in which a head thereon may be sustained for a longer period of time than is achieved by

the same beer dispensed at, say, 6°C, or at say 4°C using similar or the same dispense apparatus. Yet a further advantage of one embodiment of the invention is that it enables us to provide beer in which ice may develop therein as an interesting visual display.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a diagrammatic view of apparatus for delivering cooled draught beer;

Figure 2 is a diagrammatic view showing in side elevation a drinking vessel filled with beer delivered by the apparatus in Figure 1, the vessel being shown standing on apparatus represented diagrammatically to apply ultrasound signals to the beer;

Figures 3 to 9 show diagrammatically in side elevation successive changes in the development or variations in the head on the beer subsequent to the beer being subjected to ultrasound signals and also to development or variation in ice formed in the beer;

Figure 10 is a diagrammatic view of an alternative method of applying ultrasound signals to the beer;

Figure 11 is a diagrammatic view of yet a further method of applying ultrasound signals to the beer;

Figure 12 shows a pint of lager being excited by ultrasound; and

Figure 13 shows the pint of lager of Figure 12 after it has been allowed to stand for 3 minutes.

With reference to Figure 1, apparatus to supply beer on draught is indicated at 2. It is similar to that disclosed in aforesaid application no. GB 9810309.6.

The draught beer is stored in a keg or cask 4 which may be made of metal. The cask 4 can be stored in a cold-room known per se in public houses or clubs and/or, if desired, in a more specific cold or cooled enclosure 6, for example a tank containing a chilled mixture of water and ethylene glycol. As stated above the beer has a water content and a dissolved gas content. This gas may be any suitable non-oxidising gas, for example carbon dioxide and/or nitrogen. The amount of gas dissolved in the beer may be within the usual known range for beers, and the pressure within the cask 4 and the remainder of the supply apparatus (described below) may also be within the usual know range for beer supplied on draught.

The beer may be a lager, an ale, a porter, a stout, or cider. The dissolved carbon dioxide content may be greater than substantially 1 vols/vol or 2 vols/vol and may be substantially 2.2 volumes per volume, and/or the dissolved nitrogen content may be substantially 25 p.p.m. to 35 p.p.m. If desired the carbon dioxide content may be substantially 4 vols/vol or substantially 5. vols/vol. The alcohol content may be between 2.5% abv to 6 or 7% abv, preferably 4-5% abv, ±1% abv.

The beer may be a flavoured alcoholic beverage.

A pump 8, arranged to operate substantially only when the manually-operable valve 10 is open, is provided to pump beer from the cask 4 along a pipe 12 ultimately to the valve 10 and a dispense outlet 14 therefrom. In known manner, a blanket or atmosphere of non-oxidising/pressurised gas (for example carbon dioxide and/or nitrogen) is provided in the cask 4 from a suitable supply 16 and assists the pump 8 in the extraction of the beer.

A beer dispense unit is indicated generally at 18 and has a cover indicated by interrupted lines 20. The dispense unit may be mounted at or in the vicinity of a drinks' bar - for example on the top of, or incorporated into, a counter of the bar.

In proximity to the cover 20 the pipe 12 divides into two flow paths 22 and 24, each leading to the valve 10. One is formed by piping 22a, 22b, 22c and passages 26 in heat exchangers 28a and 28b, and the other is formed by piping 24a, 24b, 24c and passages 26 in heat exchangers 28c and 28d.

A chiller unit 30 circulates coolant through passages 32 in the heat exchangers 28 in series by a system comprising a coolant flow pipe 34 and a coolant return pipe 36. Beer pipes 22a and 24a can be bundled together in know manner with the coolant pipes 34 and 36 to form a python 38. The heat exchangers 28 may be plate heat exchangers.

A circulation pump 40, which may operate continuously, extends between the flow paths 22 and 24 adjacent to the junction between the pipe 12 and the flow paths. Thus, the flow paths 22, 24 and the pump 40 form a circulation loop 22, 24, 40 around which beer is continuously circulated when valve 10 is closed.

As suggested by Figure 1, in the beer dispense unit 18, the heat exchangers 28 are within the cover 20, whilst the valve 10 and outlet 14 can be on its exterior, and a portion of the circulation loop comprised by the pump 40 and sections of pipes 22a and 24a is also external of the cover and may be exposed to ambient temperature at the bar.

If desired, the pipe 12 may be incorporated in know manner into another cooling python 42 comprising flow and return pipes 44 and 46, carrying coolant from and back to a chiller unit 48.

Overall, the beer cooling arrangement - and particularly that provided by the dispense unit 18 by the heat exchangers 28 - so cools the beer that the beer issuing from the outlet 14 when valve 10 is opened at a temperature below the freezing point of water at the ambient atmospheric pressure. For example, the beer may issue at a temperature in the range of substantially -1°C to substantially -12°C into a drinking vessel or drinking glass. The range may be substantially -4°C to substantially -6°C. A target temperature of -5°C is aimed for if we use a beer with about 4.5% abv.

When the valve 10 is closed, the beer is circulated automatically around the loop 22, 24, 40 so it cannot stand still and start to freeze and block the supply path to valve 10.

Since draught beers are conventionally served with a head, the outlet 14 may include a known orifice plate, or other device, to promote foaming.

With reference to Figure 2, the draught beer 70 is delivered from the outlet 14 (Figure 1) into a drinking vessel 72, for example a glass which is preferably rather tall and preferably has a clear or transparent wall.

Preferably the vessel 72 is chilled before it receives the beer. The vessel 72 may be chilled to a temperature of substantially 4°C or less. For example a known bottle chiller may be used to chill the vessel 72 to substantially 4°C whilst a known glass froster may chill the vessel to substantially 0°C. A head of foam is shown at 74 and preferably this is some way below the top of the vessel 72 when the vessel contains a full measured volume, for example a pint, of the beer.

Immediately after the cold beer is poured into the chilled vessel 72 (or a few seconds after), the vessel is placed in a shallow depth of water 76 in a dish part 78 of an ultrasound generating apparatus 80 in which the dish 78 is securely mounted or affixed against a base part 82 containing an ultra-sonic emitter 84. The emitter 84 may be arranged to emit ultrasound signals in a frequency range of substantially 20kHz to 70kHz. For example the beer may be subject to ultrasound signals of a frequency of substantially 30 kHz or some other frequency selected from the aforesaid range, the water layer 76 providing an ultra-sonic transmission path or coupling. The beer may be subject to the ultrasound for any desired period, though usually a short period of a few seconds, for example substantially one to five seconds and more specifically about three or four seconds. The user may be able to vary the length of time that the ultrasound is applied, for example by having to hold down a switch, or by altering the setting on a control.

The result in a short time (perhaps a few seconds to the order of 10 seconds) is shown in Figure 3 in which the exposure to ultra-sonic signals has promoted a fairly dense sudden formation of a mass of bubbles 86 of the dissolved gas throughout the liquid beer 70. This causes the head 74 to increase in height. As shown in Figure 4, the head 74 may rise out of the vessel 72. The gas bubbles form nucleation sites encouraging the

quick formation of a mass of ice 88A just below the head. This ice 88A may be of a rather slushy character. For a period the mass of slush 88A grows and the head 74 rises as shown in Figure 5 but the bubbles of gas are no longer so numerous. Nevertheless they can act as nucleation sites encouraging thereat the formation of ice 88B in the body of the beer, this ice 88B may be more in the nature of flakes, for example snow type flakes, which rise and agglomerate to form a flaky mass 88C of ice on the underside of the slushy ice mass 88A. As indicated in Figs. 7 and 8 the ice flakes continue to form for a period, rise and extend the ice mass 88C downwards through the beer 70.

Going from the stage shown in Figure 2 to that in Figure 8 may only take one or two minutes so the intense gas bubbling and the formation and visible development of the ice takes place fairly quickly and can be interesting and rather amazing phenomena to observe through the glass 72.

To enhance the theatre, drama or wonder of the event for a customer at the drinks' bar the operation of the apparatus 80 may be accompanied by an automatically (or manually-actuated) occurring audible performance which may be mechanically or electrically produced using sound apparatus giving out dramatic, musical or tuneful sounds. In addition to, or as an alternative, the operation of the apparatus 80 may be, possibly automatically, accompanied by a visual lights display, for example visible flashes of light. These may simulate flashes of lightening. In that case the audible performance may comprise noise resembling thunder.

If desired, the vessel 72 when subject to the ultrasound may be concealed from the view of the customer in a bar. For example, it may be concealed from view on one or more sides in an enclosure which may be on the

counter or proximate thereto, which enclosure may be represented as a "magic" or magician's box or cabinet.

Preferably the beer is a pale colour. The beer may be lager.

Besides the ice forming in the beer 70 being an intriguing sight, it helps show the customer the beer is cold and that it has not been diluted by addition of ice from water other than that of the beer already.

The good head 74 provides insulation of the ice, particularly from overhead heat, which helps sustain the ice for longer and thus the duration of its cooling effect. Also the ice below the head 74, helps sustain the existence of the head which may last for ten minutes, fifteen minutes, or most preferably for twenty minutes or so.

In Figure 9 the head 74 though starting to collapse (at its centre and move away from the vessel's wall) after the elapse of some time, for example fifteen or so minutes, is still stubbornly remaining, insulating the ice and giving the beer an attractive presentation in the vessel 72.

An alternative method of applying the ultrasound signals is represented in Figure 10, in which after the apparatus 2 in Figure 1 has dispensed a vessel or glass 72 of beer 70 an ultrasound probe 90 powered through cable 92 is dipped into the beer for emitter 84A to give out ultrasound signals. The probe 90 may be inserted into the beer before the full measured amount is supplied to the vessel 72, or after the full measure has been poured into the vessel.

In Figure 11, the dispense outlet 14 has been arranged to act as an ultra-sonic probe, for example by providing it with an ultra-sonic emitter 88B.

The ultrasound probe 14 in Figure 11 may emit ultrasound signals whilst beer is passing through it to the vessel 72, and/or may become partially immersed in the beer as shown and emit ultrasound signals into the beer 70 in the vessel 72 whilst the measured volume of beer is still being supplied or after it has been supplied.

Figure 12 shows another pint of beverage, in this case lager, being excited at the base only by an ultrasound emitter, for example by standing the glass of beverage in couplant (water). Figure 12 shows the glass after it has been excited by ultrasound for about three seconds or so, and whilst it is still being excited by ultrasound. As will be seen, in addition to general bubble formation at a relatively modest level throughout the volume of the beverage, there is increased activity in a series of horizontal "white bands" (reference 120) about half-way up the height of the glass. Interspersed between the white bands 120 are bands which are less white-coloured (reference 122). There are typically two to four white bands visible, but increased bubble formation may occur above and below the "banded" region.

The formation of the bands gives the glass of beverage an attractive appearance for the few seconds that they last. It is believed that they may be associated with the formation of standing waves in the glass due to the ultrasound excitation, and may represent areas of the glass which might vibrate the most (although this belief is speculative and is not to be held to be limiting). The bands may form generally in the central height of the glass, but they may not be right at the middle - for example they could be one-third to two-fifths of the way down from the top (or up from the bottom).

It should also be noted that the glass of Figure 12 has a mouth 124 that is narrower than a body portion 126. It is believed that having a restricted mouth forms a deeper and longer-lasting head. This may, or may not, be associated with the fact that in comparison with the volume of beer contained a glass with a restricted mouth has a smaller exposed surface area of head than if it were in a vessel with straight sides, or outwardly flared sides.

Our trials indicate that best/better results can be achieved on pints of beer than on half-pints of beer. This may be associated with greater heat capacity of a pint of beer in comparison with a half-pint of beer, and the less effect exposure to the environment has/the less rapid the effect of the heat transfer to the local environment, when the ratio of volume of beverage: exposed surface is larger.

Figure 13 illustrates the pint of lager of Figure 12 after about three minutes have expired (or looked at another way after about ten minutes have expired - there is little change in the appearance of the glass of lager between the three minutes and the ten minutes). The head is somewhat deeper than might be expected, and slightly projects above the glass. There is a relatively thin layer of ice (of the order of a half to a few millimetres) extending under the head completely across the diameter of the glass, and there is a depending projection of flaky ice extending down perhaps two to five centimetres into the cleared beer. The projection may extend for at least three centimetres, and five centimetres is not to be taken as necessarily an upper limit to its length. The projection is generally central, but may be off-axis in comparison with the central axis of the glass. It has a narrower tip than it does base (the base being the portion adjacent the head).

It will be appreciated that creating a beverage having such an ice formation is in itself new and itself gives a visually differentiated product - which is desirable to consumers.

Moreover, creating the bands or stripes during ultrasonic excitation of the glass of beverage also creates a visually distinct product, and a differentiated mode of provision of the product to the consumer.

CLAIMS

1. Beer in an open-topped vessel wherein said beer has a head of foam over ice, said ice being formed in the beer from water of said water content.

2. A method of keeping beer in an open-topped vessel cool, said method comprising forming ice in the beer in the open-topped vessel having a cooling effect on the beer, said ice being formed in the beer from water of said water content.

3. A method of sustaining cooling ice in beer in an open-topped vessel and wherein said ice is formed in the beer from water of said water content, said method comprising providing a head of foam on the beer such that in the vessel said ice is covered by the head which acts as heat insulation above the ice against heat directed towards the ice from above the head.

4. A method of sustaining a head on beer in an open-topped vessel, said method comprising providing said head on the beer and forming ice in the beer from water of said water content, and in said vessel said ice having a cooling effect on the head from below an upper part of the head.

5. Beer as claimed in claim 1 or a method as claimed in any one of claims 2 to 4, in which the beer has been subjected to the effect of ultrasound signals and the beer is draught beer delivered into the vessel.

6. Beer or a method as claimed in claim 5, in which immediately before the draught beer is delivered into the vessel said beer is cooled to a

temperature below the freezing point of water at ambient atmospheric pressure.

7. A method of serving draught beer in an open-topped vessel, said method comprising cooling the beer to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled beer into said vessel, said cooled beer being subjected to the effect of ultrasound signals.

8. Beer as claimed in claim 5 or claim 6, or a method as claimed in claim 7, in which the ultrasound signals are applied externally of said vessel.

9. Beer as claimed in claim 5 or claim 6 or claim 8, or a method as claimed in claim 7 or claim 8, in which the ultrasound signals are applied internally of said vessel to the cooled beer.

10. Beer as claimed in claim 9 or a method as claimed in claim 9, in which an ultrasound signal emitter is disposed in the beer in the vessel for emitting ultrasound signals into the beer in the vessel.

11. Beer as claimed in any one of claims 8, 9 or 10, or a method as claimed in any one of claims 8, 9 or 10, in which a dispense outlet or nozzle from which beer is delivered into said vessel is adapted to act as an ultra-sonic emitter to provide aforesaid ultrasound signals.

12. Beer as claimed in claim 11 or a method as claimed in claim 11, in which aforesaid ultrasound signals are applied to aforesaid beer flowing through the dispense outlet.

13. Beer as claimed in any one of claims 5 to 12, or a method as claimed in any one of claims 5 to 12, in which the ultrasound signals have a frequency in the range of 20kHz to 70kHz.

14. Beer or a method as claimed in claim 13, in which the ultrasound signals have a frequency of substantially 30kHz.

15. Beer as claimed in any one of claims 1, 5, 6 or 8 to 14, or a method as claimed in any one of claims 2 to 4 or 7 to 14, in which a mass of said ice develops downwards in the beer below the head.

16. Beer as claimed in any one of claims 1, 5 or 6 or 8 to 15, or a method as claimed in any one of claims 2 to 4 or 7 to 15, in which the vessel is chilled before beer is delivered thereinto.

17. Beer or a method as claimed in claim 16, in which the vessel is chilled to a temperature of substantially 4°C, or the vessel is chilled to a temperature less than 4°C.

18. Beer or a method as claimed in claim 16, in which the vessel is chilled to a temperature of substantially 0°C.

19. Beer as claimed in claim 6 or in any one of claims 8 to 18 when appended to claim 6, or a method as claimed in claim 7 or in any one of claims 8 to 18 when appended to claim 7, in which the beer is cooled to a temperature between substantially -1°C and substantially -12°C.

20. Beer or a method as claimed in claim 19, in which the beer is cooled to a temperature between substantially -4°C and substantially -6°C.

21. Beer as claimed in any one of claims 1, 5, 6 or 8 to 20, or a method as claimed in any one of claims 2 to 4 or 7 to 20, in which the vessel has a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion.

22. Beer or a method as claimed in claim 21, in which the vessel is a glass drinking vessel.

23. Beer as claimed in any one of claims 1, 5, 6 or 8 to 22, or a method as claimed in any one of claims 2 to 4 or 7 to 22, in which the beer is a pale beer in colour.

24. Beer or a method as claimed in claim 23, in which the beer is a lager.

25. Beer as claimed in any one of claims 1, 5, 6 or 8 to 24, or a method as claimed in any one of claims 2 to 4 or 7 to 24, in which aforesaid dissolved gas comprises carbon dioxide and/or comprises nitrogen.

26. Beer or a method as claimed in claim 25, in which the dissolved nitrogen content in the beer is in the range of substantially zero parts per million (p.p.m.) to substantially 100 parts p.p.m.

27. Beer or a method as claimed in claim 25 or in claim 26, in which the dissolved carbon dioxide content is about zero % by volume or greater.

28. Beer or a method as claimed in claim 27, in which the carbon dioxide is substantially 2.2.% or substantially 4% or substantially 5% by volume.

29. Beer as claimed in claim 5 or claim 6, or in any one of claims 8 to 28 when appended to claim 5, or a method as claimed in claim 7, or in any one of claims 8 to 28 when appended to claim 7, in which the ultrasound signals are accompanied by a mechanically or electrically produced audible performance and/or a visible light display.

30. Beer or a method as claimed in claim 29, in which the audible performance is a tuneful or musical sound.

31. Beer or a method as claimed in claim 29 or claim 30, in which the visible light display comprises visible flashes of light.

32. Beer as claimed in claim 5 or claim 6, or in any one of claims 8 to 31 when appended to claim 5, or a method as claimed in claim 7, or in any one of claims 8 to 31 when appended to claim 7, in which the beer is subjected to ultrasound within an enclosure arranged to conceal the vessel from view from at least one side of said enclosure.

33. Beer as claimed in claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

34. A method of keeping beer in an open-topped vessel cool, substantially as hereinbefore described with reference to the accompanying drawings.

35. A method of sustaining cooling ice in beer in an open-topped vessel and wherein said ice is formed in the beer from water of said water content, substantially as hereinbefore described with reference to the accompanying drawings.

36. A method of sustaining a head on beer in an open-topped vessel, substantially as hereinbefore described with reference to the accompanying drawings.

37. A method of serving draught beer in an open topped vessel, substantially as hereinbefore described with reference to Figures 1 to 9, or Figures 1 and 3 to 10, or Figures 1 and 3 to 9 and 11 of the accompanying drawings.

38. Beer or a method as claimed in any one preceding claim in which the beer is a beverage comprising hops flavouring, an alcohol content derived from malt and fermentation, a water content, and a dissolved gas content.

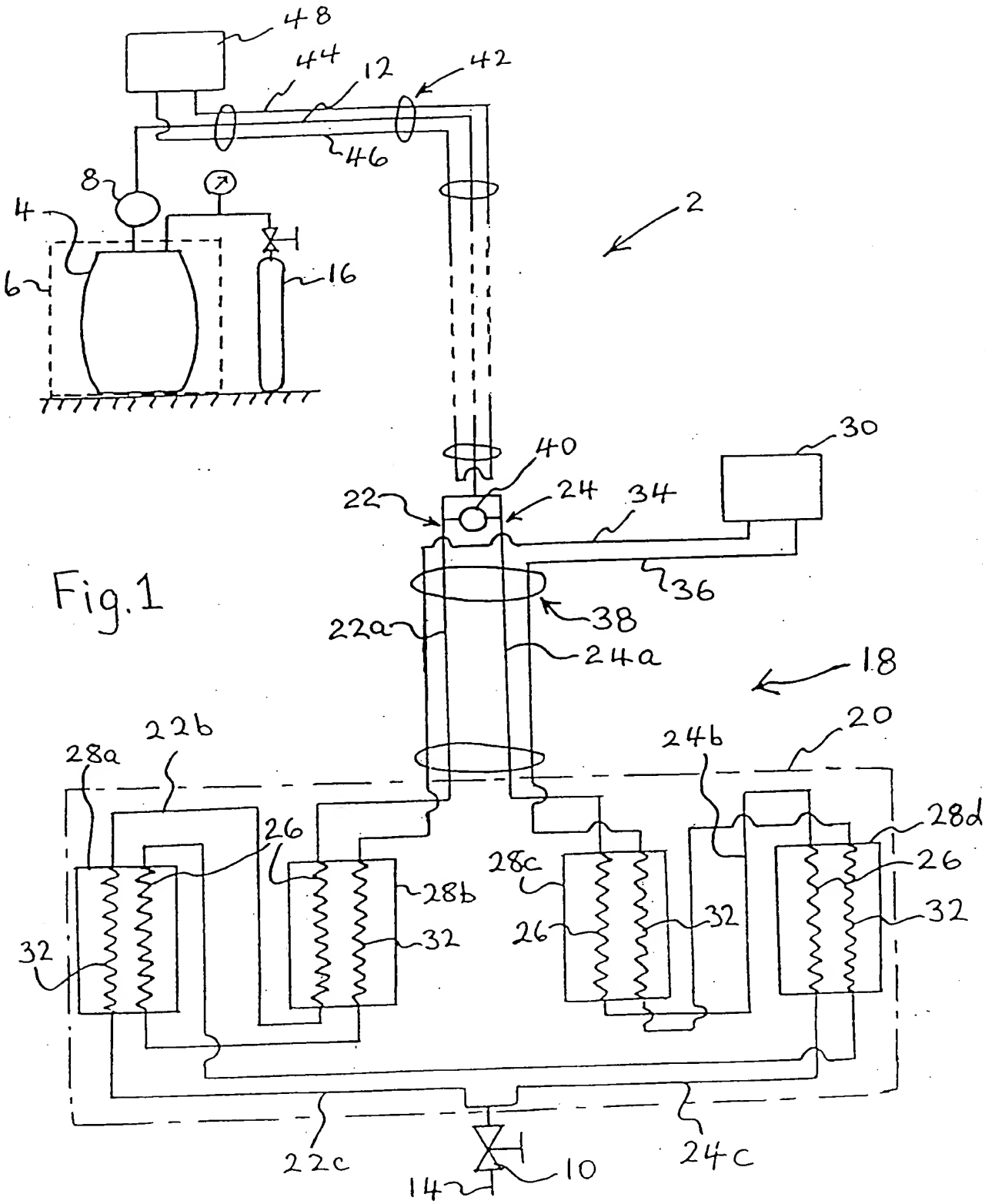
48
44
12
42
46
8
4
6
16
2
30
40
22
24
34
36
38
22a
24a
18
20
22b
28a
24b
26
28d
28c
28b
32
22c
24c
14
10

Fig.1

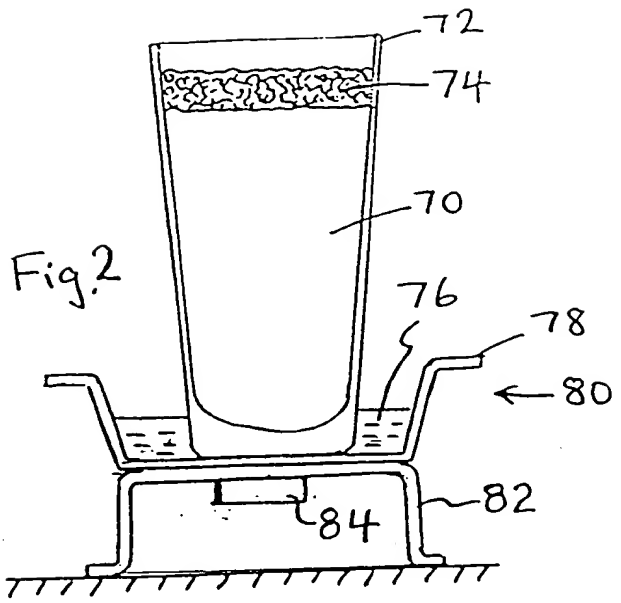

Fig.2

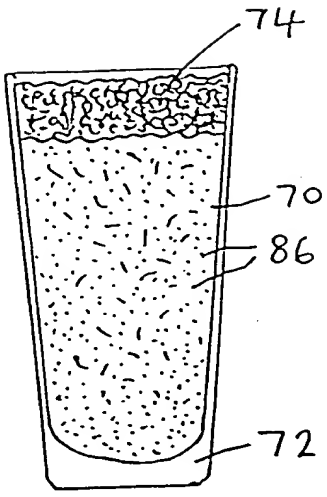

Fig.3

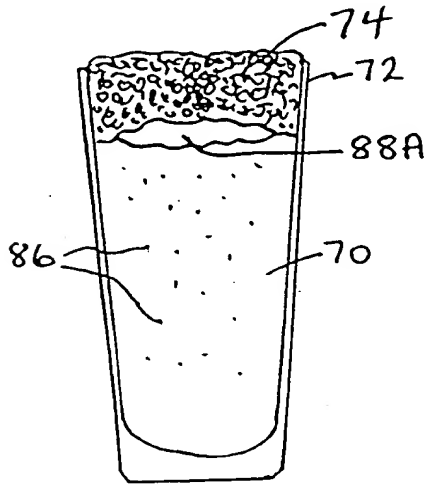

Fig.4.

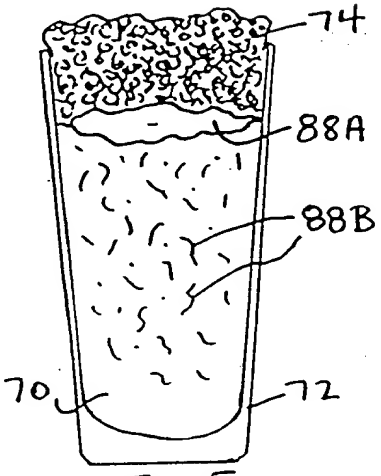

Fig.5

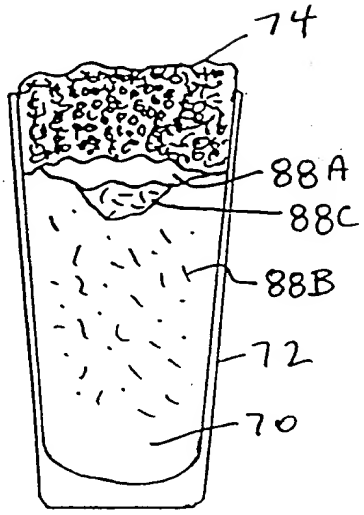

Fig.6

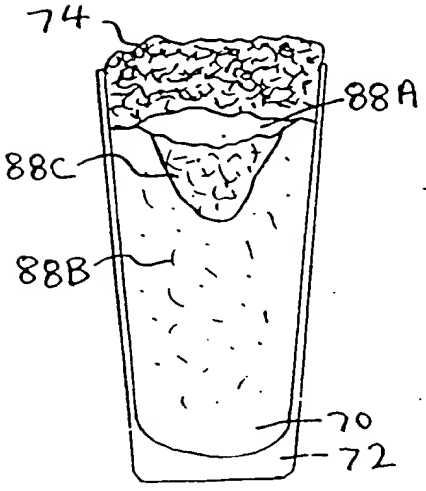

Fig.7

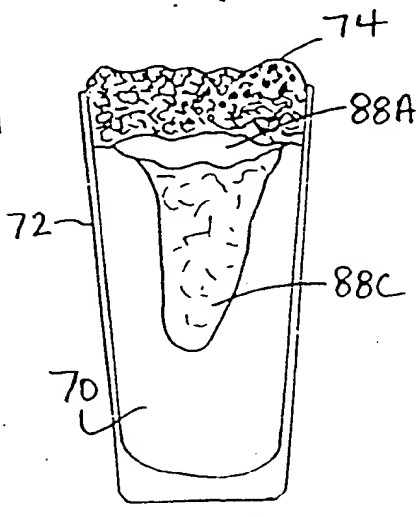

Fig.8

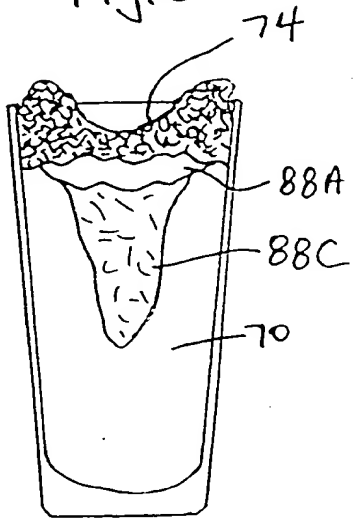

Fig.9

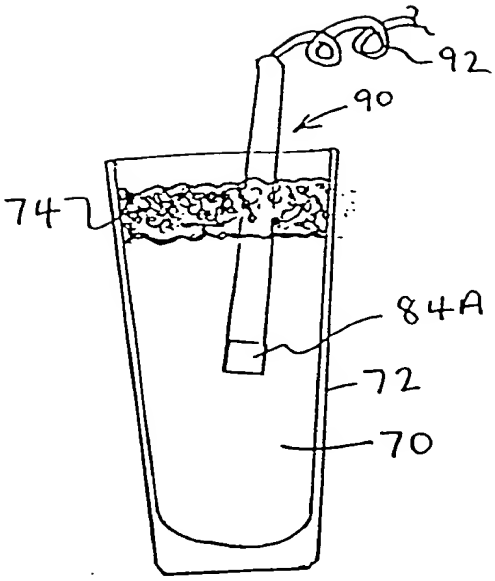

Fig. 10

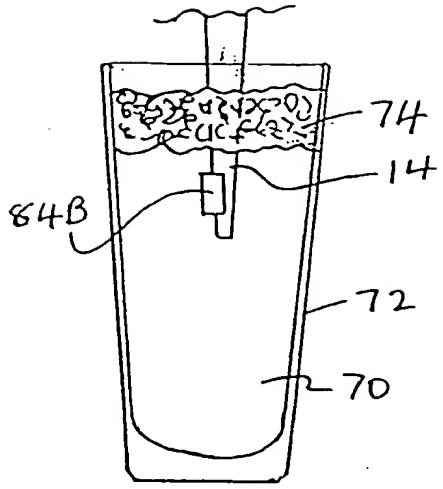

Fig. 11

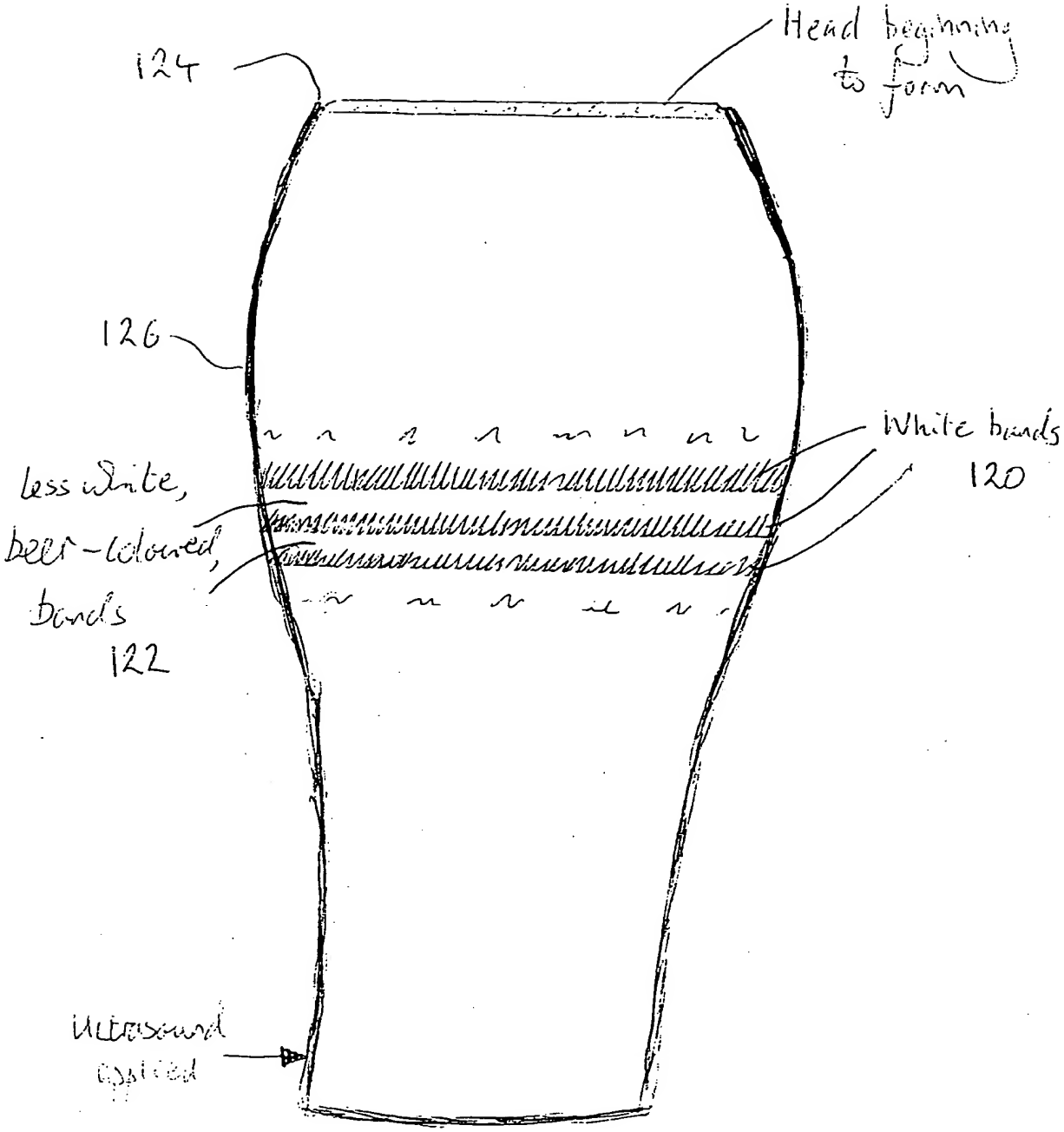
124
Head beginning to form
126
White bands 120
less white, beer-coloured, bands 122
ultrasound applied

FIG. 12

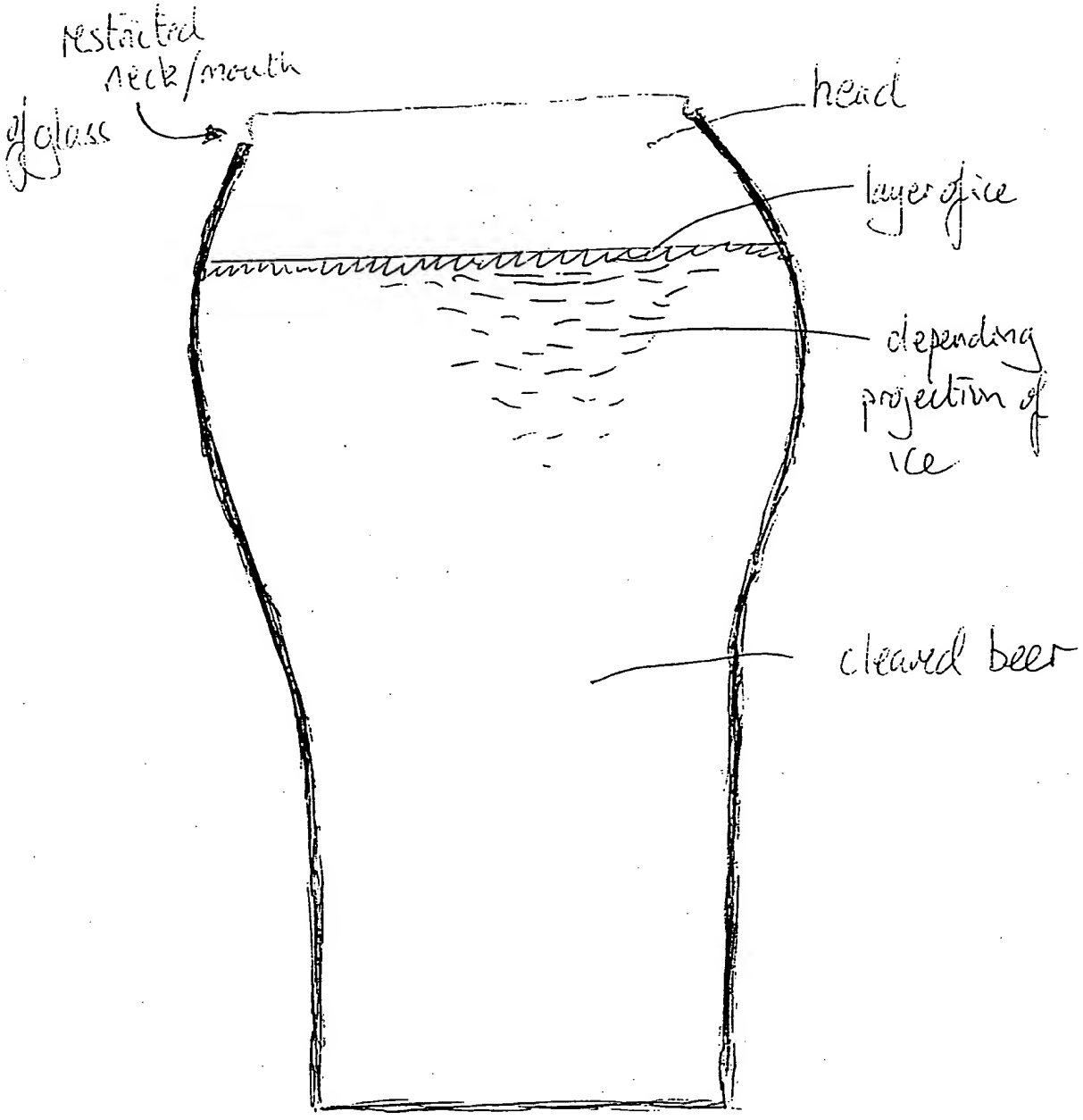
restricted neck/mouth of glass
head
layer of ice
depending projection of ice
cleared beer

FIG. 13